In the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

1. (Original) A method for I/Q mismatch calibration of a receiver having an I/Q correction module which performs $x_o[n] = A_p \cdot x_i[n] + B_p \cdot x_i^*[n]$ where $x_i[n]$ and $x_o[n]$ respectively represent the input and output signal of the I/Q correction module, the superscript * refers to a complex conjugate, and A_p and B_p are correction parameters, comprising the following steps:

generating a test signal $x(t)$ containing a single tone waveform with frequency of (f_c+f_T) Hz , where f_c and f_T are real numbers;

applying I/Q demodulation to reduce the central frequency of the test signal $x(t)$ by f_c Hz and output a demodulated signal $x_{dem}(t)$;

converting the demodulated signal $x_{dem}(t)$ to a digital signal $x_{dem}[n]$;

obtaining measures U_1 and U_2 of the digital signal $x_{dem}[n]$ where U_1 and U_2 are values indicative of the frequency response of $x_{dem}(t)$ at frequency $+f_T$ Hz and $-f_T$ Hz, respectively; and

calculating the set of the correction parameters A_p and B_p for the I/Q correction module based on the measures U_1 and U_2.

2. (Original) The method for I/Q mismatch calibration of a receiver as claimed in claim 1, the measure U_1 and U_2 are obtained from the coefficients of the Fourier transformation of the $x_{dem}[n]$ corresponding to the frequency $+f_T$ Hz and $-f_T$ Hz.

3. (Original) The method for I/Q mismatch calibration of a receiver as claimed in claim 1, wherein the test signal $x(t)=\cos(2\pi(f_c+f_T))$.

4. (Original) The method for I/Q mismatch calibration of a receiver as claimed in claim 1, wherein the set of correction parameters (A_p,B_p) are obtained by

$$\begin{cases} A_p = R + j\alpha S \\ B_p = -\alpha R - jS \end{cases}$$

where α, R, and S are obtained based on U_1 and U_2.

5. (Original) The method for I/Q mismatch calibration of a receiver as claimed in claim 4, wherein α, R, and S are obtained based on

$$H = real(U_1 \cdot U_2),$$

$$I = imag(U_1 \cdot U_2),$$

and

$$G = |U_1|^2 + |U_2|^2 .$$

6. (Original) The method for I/Q mismatch calibration of a receiver as claimed in claim 4.1, wherein α, R, and S are obtained by

$$\alpha = \frac{H}{\kappa},$$

where

$$\kappa = \frac{G + \sqrt{G^2 - 4H^2}}{2},$$

and

$$R = \sqrt{\frac{1+P}{2}},$$

$$S = \sqrt{\frac{Q}{2 \cdot \sqrt{\frac{1+P}{2}}}},$$

where

$$Q = \frac{2 \cdot I}{\kappa \cdot (1-\alpha^2)},$$

$$P = \sqrt{1 - \left(\frac{2 \cdot I}{\kappa \cdot (1-\alpha^2)}\right)^2}.$$

7. (Original) The method for I/Q mismatch calibration of a receiver as claimed in claim 4, wherein the set of correction parameters (A_p, B_p) is further normalized such that the power of the output signal of the I/Q correction module equals to that of the input signal of the I/Q correction module.

8. (Original) An apparatus for I/Q mismatch calibration of a receiver having an I/Q correction module which performs $x_o[n] = A_p \cdot x_i[n] + B_p \cdot x_i^*[n]$ where $x_i[n]$ and $x_o[n]$

respectively represent the input and output signal of the I/Q correction module, the superscript * refers to a complex conjugate, and A_p and B_p are correction parameters, comprising:

a signal generator for generating a test signal $x(t)$ which contains a single tone waveform with frequency of (f_c+f_T) Hz, where f_c and f_T are real numbers;

a demodulator for applying I/Q demodulation to reduce the central frequency of the test signal $x(t)$ by f_c Hz and outputting a demodulated signal $x_{dem}(t)$;

A/D converters for converting the demodulated signal $x_{dem}(t)$ to a digital signal $x_{dem}[n]$;

a dual-tone correlator for obtaining measures U_1 and U_2 of the digital signal $x_{dem}[n]$ output from the I/Q correction module where U_1 and U_2 are values indicative of the frequency response of $x_{dem}(t)$ at frequency $+f_T$ Hz and $-f_T$ Hz, respectively; and

a processor for obtaining the set of the correction parameters A_p and B_p according to the measures U_1 and U_2.

9. (Original) The apparatus for I/Q mismatch calibration of a receiver as claimed in claim 8, the measure U_1 and U_2 are obtained from the coefficients of the Fourier transformation of the $x_{dem}[n]$ corresponding to the frequency $+f_T$ Hz and $-f_T$ Hz.

10. (Original) The apparatus for I/Q mismatch calibration of a receiver as claimed in claim 8, wherein the test signal $x(t)=\cos(2\pi(f_c+f_T))$.

11. (Original) The apparatus for I/Q mismatch calibration of a receiver as claimed in claim 8, wherein the set of correction parameters (A_p,B_p) are obtained by

$$\begin{cases} A_p = R + j\alpha S \\ B_p = -\alpha R - jS \end{cases}$$

where α, R, and S are obtained based on U_1 and U_2.

12. (Original) The apparatus for I/Q mismatch calibration of a receiver as claimed in claim 11, wherein α, R, and S are obtained based on

$$H = real(U_1 \cdot U_2),$$

$$I = imag(U_1 \cdot U_2),$$

and

$$G = |U_1|^2 + |U_2|^2.$$

13. (Original) The apparatus for I/Q mismatch calibration of a receiver as claimed in claim 12, wherein α, R, and S are obtained by

$$\alpha = \frac{H}{\kappa},$$

where

$$\kappa = \frac{G + \sqrt{G^2 - 4H^2}}{2},$$

and

$$R = \sqrt{\frac{1+P}{2}},$$

$$S = \sqrt{\frac{Q}{2 \cdot \sqrt{\frac{1+P}{2}}}},$$

where

$$Q = \frac{2 \cdot I}{\kappa \cdot (1-\alpha^2)},$$

$$P = \sqrt{1-\left(\frac{2 \cdot I}{\kappa \cdot (1-\alpha^2)}\right)^2}.$$

14. (Original) The apparatus for I/Q mismatch calibration of a receiver as claimed in claim 11, wherein the set of correction parameters (A_p, B_p) is further normalized such that the power of the output signal of the I/Q correction module equals to that of the input signal of the I/Q correction module.